

## A COMPARISON OF MOTHS RECORDED AT THE WRITTLE COLLEGE ROTHAMSTED TRAP 1968-1993 AND 2000-2004 WITH THE NATIONALLY COLLECTED DATA

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### Abstract

Moth trapping using a Rothamsted trap has taken place on the Writtle College estate in Essex since 1968. Over the period 1968 to 1993 moth species richness and abundance was generally on the increase, but trapping ceased in 1993. It was restarted in 2000 and over this second period moth species richness had fallen by 21%, but catch abundance has increased by 25% when compared to the first period. This was not in line with national data, as overall Rothamsted catches have fallen by nearly one third. Results from 2000 to 2004 for the 17 most numerous species caught at Writtle between 1968 and 1993, revealed that 11 have now reduced in number, five have increased whilst one is stable.

### Introduction

Rothamsted light traps have used to catch moths at Writtle since 1968, but nationally these have not been analysed until recently (Fox *et al.*, 2006). At Writtle trapping had taken place since the start of the scheme in 1968, but finished in 1993 when the science laboratories moved and the trap was dismantled. The data from 1968 to 1993 (no data collected 1973, 1982 and 1983) was evaluated by Gardiner and Field (2001; 2004) and 17 of the most commonly caught species identified. At that time 39,953 individual macro-moths comprising 345 species had been recorded. The number of moths caught was fairly stable over the period with 1975 and 1976 being very good years. The species richness increased towards the end of the period but once again 1975 and 1976 were the best years.

Analysis of the Writtle data up to 1993 seemed to suggest that there was little to worry about in terms of moth abundance and species richness. However, the information gathered nationally from 1968-2002 indicates a different representation (Fox *et al.*, 2006). The total number of moths recorded in Rothamsted trap samples has declined by a third since 1968. Population trends have been calculated for 337 common species of which 226 species show a decreasing trend. Application of the IUCN criteria suggests that 71 species (21%) of these common moths are threatened. Of these, following Fox *et al.* (2006), 15 species could be classed as 'Endangered' and 56 can be classed as 'Vulnerable'. Of the 17 most common moths (species with over 500 recorded adults) found at Writtle between 1968 and 1993 (Gardiner and Field, 2001), one could now be classed as 'Endangered' and two could be classed as 'Vulnerable'.

The authors will investigate how moth species richness and abundance has varied from the first trapping period of 1968-1993 to the second period 2000-2004 and what effects, if any, are there on the 17 most common species at Writtle. A comparison of the abundance of these 17 species will also be drawn between local and national data.

## Methods

Writtle College is located in the south-east of England, two kilometres from Chelmsford in Essex (O. S. grid reference TL 670070). The College estate extends over 210 hectares and consists of agricultural, horticultural and conservation areas, of which about 15 hectares of conservation meadows, pastures, field margins and set-aside have been established since the mid 1990s. The Rothamsted trap was reinstated in 2000, not in the original position next to the main building but about 500 metres south, next to the new science centre and within the weather station compound. The old trapping site was within a parkland type setting with lawns and mature trees, with a large orchard some 200 metres away. The new site was on the edge of the farm with arable fields on one side and native trees and grassland on the other. An orchard and horticultural grounds are about 300 metres from the trap. The possible effects of that change will be discussed later. The moths are collected each day and sent to Rothamsted for identification and a list received once a year stating species and number of individuals caught and the date of first and last catch.

The changes in individual moth abundance at Writtle were calculated by comparing the average catches from 1968 to 1993 to those from 2000 to 2004. It is important to highlight that this was not the method used to calculate the national trends and therefore direct comparison was impossible.

## Results

Over the period 2000-2004, on average 102 species and 2180 individuals were caught each year. The species richness recorded during 2000-2004 has decreased when compared to the average of 130 species recorded during the period 1968-1993, but the number of individuals caught has increased from the average of 1737 caught each year between 1968 and 1993 (Table 1).

During the period 2000-2004, of the 17 most common species identified by Gardiner and Field (2001) for the period 1968-1992, 11 have reduced, five have increased and one has remained stable at Writtle (Table 2). Several of these species such as Heart & Dart *Agrotis exclamatoris* (67% national decline), Mottled Rustic *Caradrina morpheus* (73% decline) and Dark-barred Twin-spot Carpet *Xanthorhoe ferrugata* (92% decline) mirror the national declines but others do not. Common Wainscot *Mythimna pallens* (64% national decline) has increased by 535%, whilst Small Square-spot *Diarsia rubi* (85% national decline) has also increased by a 172% but has shown a severe decline in 2003 and 2004. Lunar Underwing *Omphaloscelis lunosa* (100% national rise) has reduced by 64% at Writtle and is following a 8-10 year cycle of boom and bust. Smoky Wainscot *Mythimna impura* which has been stable nationally shows a 437% rise at Writtle while Common Footman *Eilema lurideola* (40% national rise) has only increased slightly at Writtle.

Four species, Silver Y *Autographa gamma*, Hebrew Character *Orthosia gothica*, Willow Beauty *Peribatodes rhomboidaria*, and Brimstone Moth *Opisthograptis luteolata* are showing larger declines at Writtle than found nationally (Table 2) and may be on the point of being lost altogether from the estate. Silver Y is an immigrant and the decline may be for reasons which lay outside Writtle.

**Table 1.** Number of moth species and individuals caught 1968-1993 and 2000-2004.

Year	No. of species	No. of individuals	Year	No. of species	No of individuals
1968	126	2128	1985	123	1846
1969	106	1249	1986	155	2181
1970	91	1684	1987	139	1553
1971	83	1110	1988	147	1794
1972	93	858	1989	127	1690
1974	145	1970	1990	154	1594
1975	163	3788	1991	155	1989
1976	161	3852	1992	164	1813
1977	99	740	1993	142	1278
1978	129	936	2000	98	1189
1979	123	1297	2001	104	3473
1980	127	1202	2002	87	1221
1981	113	885	2003	110	2865
1984	141	2516	2004	112	2150

Another 15 species (Table 3) trapped at Writtle between 2000 and 2004 could be classed as 'Endangered' or 'Vulnerable' (Fox *et al.*, 2006). Of these species caught between 2000 and 2004, four, Rosy Rustic *Hydraecia micacea*, Cinnabar *Tyria jacobaeae*, Blood-vein *Timandra comae* and Latticed Heath *Chiasmia clathrata*, are showing slightly increasing trends at Writtle, but one, Buff Ermine *Spilosoma luteum*, is declining. Dark Spinach *Pelurga comitata*, Mouse Moth *Amphipyra tragopoginis* and The Rustic *Hoplodrina blanda* have declined and may even now have been lost at Writtle. The remaining seven Deep-brown Dart *Aporophyla lutulenta*, Grass Rivulet *Perizoma albulata*, Large Wainscot *Rhizedra lutosa*, The Sallow *Xanthia icteritia*, Knot Grass *Acronicta rumicis*, Grey Dagger *Acronicta psi* and White Ermine *Spilosoma lubricipeda* are at very low numbers.

In total, 11 of the 'Endangered' moths species were caught between 1968 and 1993 (Table 4) but only three were caught between 2000 and 2004, of which two, Dark Spinach *Pelurga comitata* and Grass Rivulet *Perizoma albulata* had not been caught during the first trapping period. This is a 73% reduction in species richness on 'Endangered' species. 'Vulnerable' species fared only slightly better, 41 were caught between 1968 and 1993 (Table 4) but only 15 of these were still caught between 2000 and 2004. This represents a 65% reduction in species richness. During the period up to 1984, on average 0.5 'Endangered' or 'Vulnerable' species were lost each year. Between 1985 and 1993, 2.3 species were lost each year but from 1994 to 2004, the loss reduced to 0.6 species each year (Table 4).

**Table 2.** Species with over 500 records for the period 1968-1993 and catches 2000-2004.

Species	Average catch 68-93	Years seen	Catch 2000	Catch 2001	Catch 2002	Catch 2003	Catch 2004	Trend National	Trend National %
Heart & Dart <i>Agrotis exclamationis</i>	119	23	21	13	16	12	6	↓	↓88
Common Wainscot <i>Mythimna pallens</i>	118	23	423	1504	123	1012	100	↓	↑535
<b>Mottled Rustic</b> <i>Caradrina morpheus</i>	81	23	17	4	23	51	22	↓	↓71
Lunar Underwing <i>Omphaloscelis lunosa</i>	80	23	26	27	15	19	56	↑	↓64
Setaceous Hebrew Character <i>Xestia c-nigrum</i>	69	23	113	263	43	145	84	↑	↑939
Common Rustic <i>Mesapamea secalis</i>	61	22	15	107	22	56	16	↑	↓28
Riband Wave <i>Idaea aversata</i>	59	22	18	25	22	27	39	↑	↓55
Flounced Rustic <i>Luperina testacea</i>	58	20	40	22	22	18	40	↓	↓51
<b>Small Square-spot</b> <i>Diarsia rubi</i>	56	23	78	341	45	18	1	↓	↑172
Hebrew Character <i>Orthosia gothica</i>	49	23	0	4	3	0	4	↓	↓95
Smoky Wainscot <i>Mythimna impura</i>	48	21	66	195	186	305	299	→	↓437
Silver Y <i>Autographa gamma</i>	47	23	7	4	3	18	2	↓	↓85
<b>Dark-barred Twin-spot Carpet</b> <i>Xanthorhoe ferrugata</i>	35	21	0	0	0	3	0	↓	↓98
Square-spot Rustic <i>Xestia xanthographa</i>	30	20	78	85	187	203	254	↑	↑538
Willow Beauty <i>Peribatodes rhomboidaria</i>	25	18	1	0	0	1	1	↓	↓96
Brimstone Moth <i>Opisthograptis luteolat</i>	24	23	5	3	4	4	1	↓	↓85
Common Footman <i>Eilema lurideola</i>	23	21	16	21	22	31	36	↓	→

↑ - increasing

↓ - decreasing

→ - stable

**Bold** trend figures – 'Endangered' or 'Vulnerable' species nationally (Fox *et al.*, 2006)

**Table 3.** Other 'Endangered' and 'Vulnerable\*' moth species trapped at Writtle 2000 to 2004.

	Average catch 68-93	Catch 2000	Catch 2001	Catch 2002	Catch 2003	Catch 2004	Trend National	Trend Writtle
<b>Grass Rivulet</b> <i>Perizoma albulata</i>	0	0	0	0	0	1	↓	→
<b>Dark Spinach</b> <i>Pelurga comitata</i>	0	1	0	1	0	0	↓	X
Deep-brown Dart <i>Aporophyla luteolata</i>	11	2	0	0	1	2	↓	↓
Latticed Heath <i>Chiasmia clathrata</i>	5	4	0	0	34	37	↓	↑
Large Wainscot <i>Rhizedra lutosa</i>	<1	0	0	1	0	0	↓	→
Rosy Rustic <i>Hydraecia micacea</i>	4	2	5	10	13	19	↓	↑
Cinnabar <i>Tyria jacobaeae</i>	<1	2	0	2	1	14	↓	↑
The Sallow <i>Xanthia icteritia</i>	<1	1	0	0	0	0	↓	→
Knot Grass <i>Acronicta rumicis</i>	<1	0	1	0	0	0	↓	→
Blood-vein <i>Timandra comae</i>	10	2	18	11	23	19	↓	↑
Grey Dagger <i>Acronicta psi</i>	<1	1	0	0	0	0	↓	→
White Ermine <i>Spilosoma lubricipeda</i>	14	1	5	3	7	2	↓	↓
Rustic <i>Hoplodrina blanda</i>	2	4	15	5	0	0	↓	X
Mouse Moth <i>Amphipyra tragopoginis</i>	7	3	1	0	0	0	↓	X
Buff Ermine <i>Spilosoma luteum</i>	9	3	2	8	7	6	↓	↓

↑ - increasing

↓ - decreasing

→ - stable

X - in danger of being lost or already lost from Writtle

**Bold** trend figures – 'Endangered' species nationally (Fox *et al.*, 2006)\* - 'Vulnerable' - status category determined in Fox *et al.* (2006)

### Discussion

Fox *et al.* (2006) suggest several reasons for the national decline in larger moths and have discovered that the south-east of Britain has the greatest proportion of substantial declines when compared to the south-west and the north. They highlight the loss of natural habitats, with 97% of lowland flower-rich grassland lost, 75% coppiced woodland lost, 50% ancient broad-leaved woodlands lost and 40% lowland

heath lost, all since the 1940s (Asher *et al.*, 2001). Other reasons given for the decline of moth populations may be the increased use of pesticides (Ansell *et al.*, 2001), increased pollution from both vehicles and light, and climate change (Conrad *et al.*, 2002).

Several of these suggested reasons for the loss of moth species can be investigated on the Writtle College estate as detailed habitat management has taken place for the last 30 years. Whereas nationally the quality and quantity of native habitats have declined, at Writtle more semi-natural habitats have been created. The authors have therefore drawn up an effects table (Table 5) to help investigate wider changes to moth populations on the estate.

It is safe to suggest that until about 1974 the Writtle College estate would have fitted into the national changes in the countryside. Hedges had been removed and as much land was in production as possible. In fact the farm was one of the most productive in the county in the 1960's. From 1974 onwards a process of woodland planting and hedgerow replacement commenced. In 1976 a detailed survey of the College estate was conducted (Neate, 1979) to assess what was present. Hedgerow planting and flower-rich grassland reseeded continued through the 1980s but it was not until the early 1990s that this became larger scale. This work continued until the end of the monitoring period with more meadows and pastures sown, more hedgerows planted (under the Countryside Stewardship scheme [CSS]) and trees planted (under the Woodland Grant Scheme). This may, in part, account for the reduced loss of 'Endangered' and 'Vulnerable' moth species from 1993 as more suitable habitats were created, but still over 30 of these species have been lost.

At the same time the farm had put two fields in permanent set-aside and although these were sown with an agricultural ley mix, it was better than not having them as grassland. The farm joined the CSS in 1996 and established two and six metre wide grass margins around many of the fields and started to carry out coppicing and laying on the estates hedgerows. Thus the losses of habitat suffered in many parts of the country were not as prevalent at Writtle.

By the late 1990s much of the amenity grassland at Writtle was being managed in a more wildlife friendly manner. Areas of long grass were being left, and other areas of grassland were sown with wildflowers. However, this still amounted to less than 10% of the manicured lawn area.

These increased areas of new grassland and the improvement in management of existing grassland may be one of the reasons why Common Wainscot, Small Square-spot and Smoky Wainscot have increased dramatically at Writtle but have not shown these same increases nationally. Square-spot Rustic *Xestia xanthographa* could also have increased to a greater extent at Writtle than it has done nationally for these reasons but why Lunar Underwing, Flounced Rustic *Luperina testacea* and Common Rustic *Mesapamea secalis* have also not increased is unclear. Lunar Underwing seems to be following an 8-10 year cycle of boom and bust and could increase dramatically again in the next few years.

Several species are reliant on herbaceous plants as larval food plants and more of these plants are available on the estate due to the meadow plantings. Setaceous

**Table 4.** ‘Endangered’ and ‘Vulnerable’ species lost at Writtle and year last recorded.

Endangered*	Year	Vulnerable*	Year
Dusky Thorn <i>Ennomos fuscantaria</i>	1990	Feathered Gothic <i>Tholera decimalis</i>	1985
Hedge Rustic <i>Tholera cespitis</i>	1993	Lackey <i>Malacosoma neustria</i>	1992
V-moth <i>Macaria wauaria</i>	1988	Garden Tiger <i>Arctia caja</i>	1991
Double Dart <i>Graphiphora augur</i>	1974	Dot Moth <i>Melanchra persicariae</i>	1990
Spinach <i>Eulithis mellinata</i>	1986	Large Nutmeg <i>Apamea anceps</i>	1991
Garden Dart <i>Euxoa nigricans</i> Figure of Eight	1984	Flounced Chesnut <i>Agrochola helvola</i>	1980
<i>Diloba caeruleocephala</i>	1988	Pale Eggar <i>Trichiura crataegi</i>	1989
Dusky-lemon Sallow <i>Xanthia gilvago</i>	1991	Oblique Carpet <i>Orthonama vittata</i>	1986
White-lined Dart <i>Euxoa tritici</i>	1971	Sprawler <i>Asteroscopus sphinx</i>	1986
September Thorn <i>Ennomos erosaria</i>	1978	Small Emerald <i>Hemistola chrysoprasaria</i>	1993
		Oak Hook-tip <i>Watsonalla binaria</i>	1992
		August Thorn <i>Ennomos quercinaria</i>	1988
		Brindled Beauty <i>Lycia hirtaria</i>	1993
		Red Carpet <i>Xanthorhoe decoloraria</i>	1974
		Dark Brocade <i>Blepharita adusta</i>	1987
		The Streak <i>Chesias legatella</i>	1984
		Small Phoenix <i>Ecliptopera silaceata</i>	1991
		Broom Moth <i>Melanchra pisi</i>	1986
		Powdered Quaker <i>Orthosia gracillis</i>	1992
		Dusky Brocade <i>Apamea remissa</i>	1991
		Brown-spot Pinion <i>Agrochola litura</i>	1992
		Centre-barred Sallow <i>Atethmia centrago</i>	1986
		Shaded Broad-bar <i>Scotopteryx chenopodiata</i>	1993
		Minor Shoulder-knot <i>Brachylochia viminalis</i>	1985
		Shoulder-striped Wainscot <i>Mythimna comma</i>	1980
		Ear Moth <i>Amphipoea oculea</i>	1969

\* status categories determined in Fox *et al.* (2006)

Hebrew Character *Xestia c-nigrum* has increased at Writtle to a much greater extent than nationally. However, two species reliant on herbaceous plants have performed very poorly both at Writtle and nationally. Dark-barred Twin-spot Carpet could be classed as ‘Endangered’ (Fox *et al.*, 2006) nationally, and averaged less than one adult per year at Writtle during 2000-2004 whilst on average, 35 were trapped each

year between 1968 and 1993. Mottled Rustic which could be classed as 'Vulnerable' nationally (Fox *et al.*, 2006) has seen the average yearly catch reduced from 81 during 1968-1993 to less than 24 during 2000-2004. Also Riband Wave *Idaea versata* is reliant on herbaceous plants and is up slightly nationally but was 55% down at Writtle during the second trapping period.

**Table 5.** Possible positive and negative effects on moth species richness and abundance on the Writtle College estate.

Positive effects	Negative effects
Creation of native grassland	Reduced variety of arable and horticultural crops
Set-aside grassland	Loss of orchards
Tree and hedge planting schemes (native species)	Increased building development on the estate
Less intensive management of amenity grassland (less regular cutting and areas left long)	Increased light pollution
Good hedgerow management	Increased traffic and more emissions
Climate change	Climate change
Movement of trap	Movement of trap
Creation of arable field margins	Use of pesticides on crops

The movement of the trap from its original site is suggested as a positive and a negative effect (Table 5). It is suspected that the decline in catches of three species can in part be put down to that move. Hebrew Character, Willow Beauty and Brimstone Moth would have all favoured the trees found around the original trap, whereas the new site is more open. Grassland species such as Common Wainscot, Small Square-spot and Smoky Wainscot may well have benefited from the movement of the trap to an area which was more suitable for them with tall grassland nearby.

The changing variety of crops grown at Writtle could have had an effect on various species. The orchards were mainly removed in the late 1990's and this may have affected the abundance of the Brimstone Moth whilst the reduction in horticultural crops grown may have affected the abundance of the Silver Y. Heart & Dart which has declined nationally and at Writtle, uses a wide range of habitats such as lowland arable farmland, pasture and gardens (Waring and Townsend, 2003). This species could have suffered from the change in trap position and the reduction in the variety of crops grown and increased pesticide use, but these reasons may not explain the large drop nationally. Thus they may not be the main reason for the reduction in abundance of this species on the College estate.

Since 1993 there has been an expansion of the College facilities due to a growth in student numbers. New buildings have been erected, new car parks built and extra outdoor lights put up. The increased number of students has meant more cars, more



disturbance and more light pollution. The traffic through Writtle village has increased over the period generating more pollution. This could be part of the reason for the lack of an increase at Writtle of the Common Footman as nationally it showed an increase of 40%. The larvae of this species feed on lichens and whereas the air quality may have improved in many parts of the country, fewer lichens grow in the more polluted south-east of England.

Climate change is also identified as both a positive and negative effect and only time will tell whether more or less species are favoured by our changing climate. From the data obtained from the Rothamsted trap at Writtle it seems impossible to identify any trends with regard to climate change other than to say that if it is happening to any great extent then there are no signs that it is favouring moth species richness at the moment.

### Conclusions

For various reasons suspected and unknown, moth species richness had declined by 2004 to a level found in the late 1960s and early 1970s at Writtle. With regard to moth abundance, even though nationally catches are down by approximately a third (Fox *et al.*, 2006) the catches at Writtle have remained stable with 2001 and 2003 being the 3rd and 4th best years behind 1976 (1st) and 1975 (2nd) over the period 1968-1993 and 2000-2004.

Of the 17 most abundant moth species trapped during the period 1968 to 1993, six would now not feature using data from 2000-2004. These include the most abundant species from 1968 to 1993, Heart & Dart, Brimstone Moth, Willow Beauty, Dark-barred Twin-spot, Silver Y and Hebrew Character. Their places could be taken by species which have increased dramatically nationally such as Straw Dot *Rivula sericealis* (188%), Least Carpet *Idaea rusticata* (41,696%), Cloaked Minor *Mesoligia furuncula* (114%) and Vine's Rustic *Hoplodrina ambigua* (413%) (Fox *et al.*, 2006).

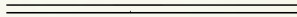
The exact reasons for these trends are unknown and without in-depth research into each species they may never be known. Other data sets from long running Rothamsted sites should be evaluated to establish whether they help to clarify the situation. It could be that, especially in the south-east, we have reached a critical point with habitat loss, development pressures and pollution and maybe even climate change all adversely affecting moth abundance and species richness, to a point they can not recover from.

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### ***Calamotropha paludella* (Hb.) (Lep.: Pyralidae) in Herefordshire**

Being unable to sleep on the exceptionally warm night of 29 July 2006, I was suddenly aware of a small moth flying around the bed. This, when boxed and identified the following morning, proved to be *Calamotropha paludella* only the second county record for this species, the first record having been made at Ledbury on 2 July 2005 by M. W. Harper (*antea*: 263). The larva feeds on *Typha latifolia* and there is a good stand of the foodplant approximately 100 yards from the house. The moth seems quite scarce in this region and there are only two records for the neighbouring county of Gloucestershire: For East Gloucestershire (VC 33) there is a record from Gloucester on 2 July 2001 (*Ent. Rec.* **114**: 280) and for West Gloucestershire (VC 34) there is one from the Wildfowl and Wetlands Trust site at Slimbridge, on 6 August 1999.— M. J. LEECH, Lyston House, Wormelow, Herefordshire HR2 8EL.